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AN INVESTIGATION OF MILLET.

(ABSTRACT.)

By L. E. SAYRE, University of Kansas, Lawrence.

ON MARCH 8, 1910, I received a letter from O. O. Wolf, secretary of the State Board of Veterinary Examiners, Ottawa, Kan., enclosing a letter, which read as follows:

> DEAR SIR—Last week I wrote a party at Wakefield to send you a sample of millet, which I would be glad to have you examine.
>
> The millet was grown on ground that had been in alfalfa for eleven years, and used as a hog pasture for nine years prior to the time of sowing the millet. It was thought, from the great amount of nitrogen that would naturally be stored up in the soil as a result of this treatment, possibly some cyanide had developed in the millet. Ten head of horses have died on the farm where this was grown, in a short time—since December 13, 1909. On the evening previous to that date the horses were fed millet, and one was dead in the morning. One died the next morning and one on the day following. Two of them were found dead in their stalls, while the remaining eight lasted from one to ten days. A young mare is still alive that has been ailing for over three weeks. They received no millet since the 15th of December.
>
> They go down and are unable to get up. The one still alive can stand and get around when helped up. They lose control of the tail, have difficulty in swallowing, and seem nervous. Aside from that they are apparently normal; appetite good, temperature nearly normal, occasionally subnormal; pulse usually somewhat increased in frequency.
>
> Will greatly appreciate any suggestion you may make.
>
> Yours very truly, O. O. WOLF.

Two hundred and fifty grams of the above millet, consisting of leaves, stems and a few tops, were ground to a very fine powder by aid of the drug mill. The resulting powder was extracted by process of percolation, using as the menstruum an alcoholic solution—alcohol three parts and water one part. The tincture thus obtained had a decided green color, with a light brownish tint.

The tincture was evaporated to a small volume, 25 cc., at a temperature not exceeding 55° C., a fan, blowing hot, dry air over the tincture, being used to hasten vaporization.

To this concentrated solution 50 cc. of $N_{10}HCl$ were added, immediately causing a heavy resinous precipitate to be deposited. The acidulated solution was filtered into a separatory funnel and shaken out with immiscible solvents, using 15 cc. of ether twice and 10 cc. of ether twice, and again shaken with the same amount of chloroform. The residues left on evaporating spontaneously the etheral and chloroformic solutions were identical. Both residues were examined carefully through a microscope for crystalline forms, but none could be found. Both were of a yellowish-green amorphous substance, having a drug-like odor and a slight bitter taste. The yield was small, 0.0979 grams being extracted from the 250 gm. of millet. This residue or glucoside (?) was dissolved in 10 cc. of alcohol, 5 cc. being set aside for future examination and the other evaporated to 3.3 cc. at a temperature not above 55° C., and 3.3 cc. each of water and pure glycerine were added to the 3.3 cc. alcoholic solution of the glucoside, making 10 cc. of a 0.5 per cent solution of the glucoside.

This solution, on injecting it into the lymph sack of lively frogs proved to have a decided toxic effect, even in very small quantities. At present we are not prepared to state definitely the quantity of glucoside necessary to produce a fatal effect on frogs.

Control experiments, using the solvent of the glucoside only, demonstrated that the toxic effect was due to the glucoside present in the above solution.[1]

CHEMICAL ANALYSIS OF HUNGARIAN MILLET.

Air-dried Material.

Crude protein.	Fiber.	Ash.
6.7 %	31.6 %	0.23 %

Oven-dried Material.

Constant weight, 100° C.	Seeds.	Stems.	Leaves.
SiO_2	18.73%	24.32%	22 62%
$F_2O_3Al_2O_3$	4.15	4.62	3.85
CaO	14.55	11.48	13 44
MgO	2.78	1.82	2.85
KNaS	58.84	55.89	56.12
Totals	99.05%	98.13%	98.88%

ANALYSIS OF SOIL ON WHICH MILLET WAS GROWN.

Loss on ignition	11.04%
Alkalies (calculated as potassium oxide)	0.45
Acid insoluble	77.10
Ferric oxide	2.56
Alumina	6.34
Phosphorus pentoxide	.70
Calcium oxide	.83
Manganese oxide	Trace.
Sulphur trioxide	Trace.
Magnesia	.56
Undetermined	.42
Total	100.00%

From this examination it would appear that there was a toxic principle of glucosidal character residing in this specimen of millet;

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[1] For the study of physiological action I am indebted to Dr. Ida Hyde.

that the millet also contained an excess of alkali. It is probable that the soil had something to do with the large percentage of toxic principle, as it is well known that variation in soil constituents has a marked effect upon the increase in toxic principles where they are liable to exist. Millet under normal conditions has a diuretic effect and throws a vast amount of work upon the kidneys, which, when overworked, produce muscular disorders.